



Announcement

# AN INTERNATIONAL MULTIDISCIPLINARY CONFERENCE INTELLIGENT SYSTEMS: A SEMIOTIC PERSPECTIVE

October 20–23, 1996  
Gaithersburg, Md., USA

Sponsored by:  
NIST, NSF, IEEE, DARPA,  
US Army Research Laboratory

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## ***Conference Description***

This conference will further enhance and broaden the productive, interdisciplinary examination begun at the Monterey Workshop on Architectures for Semiotic Modeling and Situation Analysis in Large Complex Systems, held in August of 1995 in conjunction with the 10th Symposium on Intelligent Control, sponsored by the Institute of Electrical and Electronics Engineers.

Semiotics, the science of signs and symbols, is rooted in studies of intelligence, while research on intelligent systems, whether natural or constructed, is largely concerned with semiotic issues, such as structures of language, symbolic representation of reality, extraction of meaning, and decision making. Within this large area of overlapping interests and complementing perspectives, a new domain of multidisciplinary science--applied semiotics--is beginning to emerge.

From the vantage point of this nascent field, researchers may identify new, more productive approaches to understanding intelligence and to engineering methods of intelligent control in applications ranging from manufacturing to smart cars and highways and from health care management to battlefield management. Applied semiotics can foster a merging of perspectives that may link now separate areas of intelligence research. The semiotic tools of linguistics, for example, may lend themselves to applications in robotics, while research on managing complexity in biological systems may yield insights into the management of knowledge bases and information flows in large manufacturing operations.

The underlying commonality can be traced to the steps involved in analyzing signs and symbols and in extracting their meaning. These steps entail:

- \* encoding,
- \* explaining,
- \* reproducing,
- \* synthesizing,
- \* transforming,
- \* and verifying.

### *Conference Description (cont.)*

We attribute these processes to semiotics, but they are universally applied. Deliberately or reflexively, we engage in these processes while dealing with symbolic systems, the essential constructive elements of information, knowledge, and even the human mind. In fact, it can be argued that all forms of intelligence embody a common toolkit of semiotic processes. This conference arises from the growing recognition and appreciation of the potentially unifying utility of semiotics and its tools. The study of symbolic systems, including their maintenance and interpretation, is critical to the conduct, organization, and representation of science, and it is equally critical to the application of science in technology.

This conference will survey a wide range of semiotics-related research, focusing on issues that span disciplines. Presentations and discussions will focus on existing formal and emerging methodologies for dealing with large symbolic structures. The aim is to foster broadly useful insights into the modeling, analysis, design, and application of intelligent systems.

Keynote speakers, pioneers in the areas of fuzzy logic, neural networks, robotics, and systems control, will provide their views on semiotic issues in intelligence systems research. The rest of the conference will consist of parallel tracks of invited presentations and round table discussions. While tracks will feature different sets of semiotic tools and methodologies, all will address the same themes: formation of symbols, recognition of systems, and interpretation of processes. Presenters and participants will contribute to the development of white papers summarizing the current status of activities in key areas related to semiotics and intelligent systems, as well as pointing out major research needs and opportunities.

On Sunday, October 20, the day preceding the conference, seven tutorials will be offered. Providing background perspectives on major themes to be addressed during the conference, the tutorials will survey the field of semiotics and explore applications to intelligent systems research. A separate registration fee applies to the tutorial.

### *Keynote Speakers*

**Lofti A. Zadeh**, currently Professor Emeritus of Electrical and Computer Science at the University of California, Berkeley, is widely regarded as the father of fuzzy logic and control. His paper, "Outline of a New Approach to the Analysis of Complex Systems and Decision Processes," published in 1973, laid the foundation for the technology, opening the way to what is now a rapidly growing number of commercial and industrial applications. Zadeh serves as director of the Berkeley Initiative in Soft Computing. His current research focuses on fuzzy logic, soft computing, and computing with words.

**Thomas A. Sebeok** is a Distinguished Professor Emeritus of Linguistics and Semiotics and Professor Emeritus of Anthropology, Folklore, and Central Eurasian Studies at Indiana University, where he has taught for half a century. A leader and innovator in the field of semiotics, Sebeok served for 37 years as chairman of the university's Research Center for Language and Semiotic Studies. He was a co-founder of the Semiotic Society of America as well as the International Association for Semiotic Studies, which he continues to serve as editor-in-chief of the organization's journal, *SEMIOTICA*.

**James S. Albus** is Chief of the Intelligent Systems Division at the National Institute of Standards and Technology in Gaithersburg, Md. Involved in intelligent systems research for more than 25 years, Albus has led the development of a number of experimental applications of intelligent systems, including NIST's Automated Manufacturing Research Facility and the RoboCrane, a fully automated crane based on a Stewart platform. He is also the co-developer of the NIST Real Time Control System. The winner of several honors for his work on control system theory, Albus received the Joseph F. Engelberger Award for robotics technology in 1984.

**Panos J. Antsaklis** is a Professor of Electrical Engineering at the University of Notre Dame. His research interests are in systems and control theory, with emphasis on hybrid and discrete event systems, neural networks, and reconfigurable control. A Fellow of the Institute of Electrical and Electronics Engineers, Antsaklis is a Distinguished Lecturer of the IEEE Control Systems Society, as well as the society's president-elect. The author of numerous publications on systems and control theory, he has held faculty positions at Brown University, Rice University, and the Imperial College of the University of London.

### ***Keynote Speakers (cont.)***

**Alex M. Meystel** is currently a Visiting Senior Scientist in the Intelligent Systems Division of the National Institute of Standards and Technology. He is on leave from Drexel University, where he is a Professor of Electrical and Computer Engineering. The original developer of the theory of nested multiresolutional control systems, Meystel is the author of *Autonomous Mobile Robots: Vehicles with Cognitive Control* and *Semiotic Modeling and Situation Analysis: An Introduction*. Meystel also is a co-founder of Drexel University's Center of Intelligent Modeling and Programming of Architectures for Complex Technologies, and he helped initiate the annual IEEE International Symposia on Intelligent Control.

### ***What is the Semiotic Aspect of Intelligent Systems?***

The origins of semiotics can be traced to C.S. Peirce, the 19th century American philosopher and logician who laid the field's early foundations in his book, *Logic as Semiotics: The Theory of Signs*. Even before Peirce penned his ideas in the early 1890s, however, related concepts were already being espoused. Almost three decades earlier, J.C. Maxwell used language suggestive of the semiotics paradigm while introducing the fundamentals of systems dynamics.

Today, semiotics and control theory appear ripe for synthesis, thanks to recent advances in technology--in particular, the ever-increasing speed and capabilities of computers--and in the sciences, especially mathematics, neuroscience, and the cognitive sciences. Arguably, the study of symbolic systems is relevant to nearly all scientific disciplines, but the connection to intelligent systems research, regardless of application domain, may be the strongest of all. At a minimum, intelligent agents and systems must sense their environment, make decisions, and control their actions. As the level of intelligence increases, higher-order capabilities are required, almost all of which entail perceiving, analyzing, and acting on information that is gathered and processed in the form of symbols. The tenets and tools of semiotics are fundamental to the entire array of activities crucial to an intelligent agent's ability to negotiate appropriately and successfully in an uncertain environment.

### ***What is the Semiotic Aspect of Intelligent Systems? (cont.)***

Typically, these activities involve processing many symbols in combination. Thus, intelligent systems research must encompass symbolic systems as a whole, attending to basic semiotic tasks such as object representation, extraction of meaning, symbol grounding, and complexity reduction. The challenge of complexity reduction is especially important in intelligent systems research and applications. Fortunately, many formal semiotic tools have been developed to address this problem. They include clustering, generalization, formation of new levels of representation, and searching for specific combinations of symbols.

Semiotics is a useful theoretical paradigm that embraces the various symbol processing components of intelligent systems. A semiotics perspective can be especially beneficial to efforts to develop, explain, and utilize models of intelligent agents and systems. Moreover, the tools of semiotics and its laws of syntactics, semantics, and pragmatics are applicable to the many scientific fields concerned with aspects of intelligence. Using semiotic tools and principles in these endeavors will facilitate the application of research results to future intelligent systems technologies.

### ***Why is this Conference Different from Others on Intelligent Systems?***

Most conferences on intelligent systems have concentrated on system components, confining the proceedings to, for example, neural networks, fuzzy controllers, genetic search tools, or evolutionary programming. Through its semiotics perspective, this conference focuses on a more broad spectrum of issues. Rather than looking through the lens of a particular tool, it attempts to survey the field more comprehensively, aiming to expose themes and challenges that transcend several or many tools and suggest new ways to apply those tools. The recent NSF Workshop, "Intelligent and Learning Systems" and the NSF-EPRI-NIST Workshop, "New Directions in Intelligent Systems" demonstrated the benefits of such a broad multidisciplinary approach.

### ***Why is this Conference Different from Others on Intelligent Systems? (cont.)***

Sessions on recognition or learning will examine not only standard conceptual approaches with matching or using the “oracle”, but also other approaches to utilizing a variety of different components and configurations. In addition to fuzzy systems, all tools of generalization will be considered. Similarly, many search tools will be discussed, not just genetic methods, while sessions on mechanisms of learning will consider neural network-based approaches and the alternatives.

This conference is organized as a set of workshops, each one focusing on a specific facet of the overall subject of intelligent systems and semiotics. It is expected that each workshop will develop its contribution into a “white paper,” which will be among the results of the conference.

### ***How to Prepare for this Conference***

To help conference participants prepare for this exploration of a new, multidisciplinary perspective on intelligent systems research, those who register by Sept.15 will receive a set of relevant papers and the last issue of the newsletter, “Intelligent Systems”. They also will receive collections of papers and other materials selected by the chairs of workshop sessions, as well as a copy of the publication, *Architectures of Behavior Generation* by J. Albus and A. Meystel.

Information on the conference also will be posted on the World Wide Web at: <http://isd.cme.nist.gov/proj/semiotics/semiotics.html>.

### ***Preliminary Agenda***

The conference will be organized as a set of theme-oriented workshops dedicated to issues that are key to the theory of Intelligent Systems. Each workshop will consist of the keynote lectures, round-table discussions and development of position papers. Plenary sessions will run from 8-9 a.m. each day. Morning workshops each day will be from 9:00 a.m. until lunch. Lunch will be from 1-2 p.m. Afternoon workshops will be from 2-6 p.m. each day. There will be at least one 20 minute break during each morning and afternoon workshop. A preliminary agenda follows:

#### **DAY 1, October 21: Formation of Symbols**

##### **Plenary Lectures:**

Lofti A. Zadeh (U. of California at Berkeley), The Key Role of Information Granularity in Human Intelligence (Morning)

Thomas A. Sebeok (Indiana U.), Evolution of Semiosis and the Origin of Languages (Afternoon)

#### **TRACK 1: GRANULARITY - EVOLVED, BUILT, AND NEGOTIATED**

##### ***Workshop 1.1.1: Semiotics in Biology: Biologically Inspired Complex Systems --K. Bellman (DARPA), Chair (Morning Session)***

- D. O. Walters (UCLA), Conjoined Mental Morphogenesis of Chomsky's Cartesian Linguist and Melzack's Neural Matrix
- K. Bellman (DARPA), Representations of Language, Movements, and Brains
- W. Freeman (U. of California at Berkeley), Neuzobiology: From Neuzons Through Nonlinear Dynamics to Meaning
- F. M. Brown, J. Snider (U. of Kansas), Biology, the Way it Should Have Been: Experiments with a Lamarckian Algorithm
- Other presenters: M. R. Smith (Bellcore Labs), A. Nye (U. of Wisconsin), J. Barwise (U. of Indiana)

##### ***Workshop 1.1.2: Semiotics of Constructed Complex Systems --C. Landauer (Aerospace Corp.), Chair (Afternoon Session)***

- B. Hayes-Roth (Stanford U.), Embodiment and Agency
- E. Gelenbe (Duke U.), Genetic Algorithms: A Physics Based Approach to Computing
- C. Landauer (Aerospace Corp.), Semiotics of Constructed Complex Systems

## ***Preliminary Agenda***

### **DAY 1, October 21: Formation of Symbols**

#### **TRACK 1: GRANULARITY - EVOLVED, BUILT, AND NEGOTIATED**

##### ***Workshop 1.1.2 (cont.)***

- R. Lewis (Ohio State U.), Architectures of Semiotics in SOAR
- C. C. Neves, J. O. Gray (U. of Salford, U. K.) Analysis and Extension of the Behavior Synthesis Architecture Using a Generalized Framework
- G. V. Alferov, E. E. Kolesnikov (St. Petersburg State U., Russia), Solving a Manipulator Problem with the Use of Symbol Calculation

#### **TRACK 2: DEVELOPING AND MEASURING LEARNING CAPABILITIES**

##### ***Workshop 1.2.1: Measuring Intelligence of Systems--S. Lee (Jet Propulsion Laboratory), Chair (Morning Session)***

- M. A. Arbib (U. of Southern California), From Manual Skill to Language: Assessing the Increment of Intelligence
- A. Nerode (Cornell U.), Mathematical Bases of Intelligent Systems
- A. Meystel (NIST, Drexel U.), The Degrees of Intelligence
- U. Ozguner (Ohio State U.), The Grandma and the Teenage Driver: Personality, Self-Awareness, Risk Aversion, and Other Intelligent Control Problems
- S. Lee and G. Chalfant (JPL, U. of Southern California), A Measure of Intelligence of Robotic Systems: An Engineering Perspective
- B. Stilman (U. of Colorado), Linguistic Geometry: Model Evaluation
- I. Goodman (Naval Ocean Systems Center), Describing Linguistic Uncertainty in a Behavioural Framework: Possible or Not?

##### ***Workshop 1.2.2: Intelligence of Learning and Evolution--L. Perlovsky (Nichols Research Corporation), Chair (Afternoon Session)***

- W. Freeman (U. of California at Berkeley), A Biological Model for Construction of Meaning to Serve as an Interface Between An Intelligent System and its Environments
- R. Sun (U. of Alabama), A Bottom-up Approach to Developing Symbolic Structures and Categories
- L. Goldfarb (U. of New Brunswick), The Central Role of Inductive Learning with Respect to Pattern Learning

## ***Preliminary Agenda***

### **DAY 1, October 21: Formation of Symbols**

#### **TRACK 2: DEVELOPING AND MEASURING LEARNING CAPABILITIES**

##### ***Workshop 1.2.2 (cont.)***

- L. Levitin (Boston U.), Zipf's Law Revisited: Evolutionary Model of Emergent Multiresolution Classification
- M. Lane, B. Faldasz (Tm Technologies), Prophetic Evolution
- L. Perlovsky (NRC), Fuzzy Logic of Aristotelian Forms
- L. Kanal (U. of Maryland), Acting vs. Being Intelligent: What Can We Hope for From Machines? From Humans?

#### **TRACK 3: GRANULARITY IN DECISION MAKING AND CONTROL**

##### ***Workshop 1.3.1: Fuzzy Logic and the Mechanisms of Generalization--***

##### ***L. Kohout (Florida State U.), Chair (Morning Session)***

- B. Bouchon-Meunier, C. Marsala, M. Ramdani (U. of Paris, France), Generalization from Uncertain and Imprecise Data
- L. Kohout (Florida State U.), The Dynamics of Generalization: From Fuzzy Linguistic Statements to Concepts and Constructs
- G. Klir (State U. of New York), On Fuzzy Arithmetics under Constraints
- V. Novak (U. of Ostrava, Czech Rep.), Indeterminacy, Linguistic Semantics and Fuzzy Logic
- S. Vahie, B. P. Zeigler (U. of Arizona), Dynamic Neuronal Ensembles: Issues in Representing Structure Change in Object-Oriented, Biologically-Based Brain Models
- C. Tresp, A. Becks, R. Klinkenberg, J. Hiltner (RWTH Aachen and U. of Dortmund, Germany), Knowledge Representation in a World with Vague Concepts

##### ***Workshop 1.3.2: Information Representation For Decision Making--C. Joslyn (Los Alamos National Laboratory), Chair (Afternoon Session)***

- C. Joslyn (Los Alamos National Laboratory), Hybrid Methods to Represent Incomplete and Uncertain Information
- G. de Cooman (Vakgroep Elektrische Energietechniek, (U. of Ghent, Belgium), Describing Linguistic Uncertainty in a Behavioural Framework: Possible or Not?

## ***Preliminary Agenda***

### **DAY 1, October 21: Formation of Symbols**

#### **TRACK 3: GRANULARITY IN DECISION MAKING AND CONTROL**

##### ***Workshop 1.3.2 (cont.)***

- S. Ferson (Applied Biomathematics), Propagating Uncertainty About Model Form Itself: Calculations and Decisions
- G. Klir (Binghamton U., New York), On Information-Preserving Transformations Among Three Distinct Representations of Uncertainty Based Information
- R. Viertl (U. of Technology, Vienna), The Role of Fuzzy Information in Statistical Data Analysis
- I. Goodman, G.F. Kramer (Naval Ocean Systems Center), Extension of Relative Event Algebra to a General Decision Making Setting
- P. Lehner, L. Seligman, C. Elsaesser (George Mason U.), Decision-Focused Information Pull
- T. Sudkamp (Wright State U.), Updating Possibilistic Assessments with Corroboration and Locality Information

#### **POSTER SESSION:**

- F. M. Brown, G. E. Jacobs (U. of Kansas), A Z-Based Theory of Design Change Using STEP Designs and KIN Design Intent
- L. Rocha (Binghamton University, New York), Evidence Sets: Contextualizing Uncertainty
- A. Olevanov (Belarussian State U.), Theory of Structures in the AI Context
- V. Stojkovic, W. Lupton (Morgan State U.), Solving the Nine Tiles Problem Using the Genetic Algorithm Implemented in the Maple Programming Language
- A. Chikrii, N. Gavrilova (Ukrainian Acad. Sci.), Avoidance Problem for Nonlinear Controlled Dynamic Objects
- and other papers

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### **DAY 2, October 22: Recognition of Systems**

**Plenary Lecture:** James S. Albus (NIST), A Roadmap to the Future of Intelligent Systems

## ***Preliminary Agenda***

### **DAY 2, October 22: Recognition of Systems**

#### **TRACK 1: FORMAL STRUCTURES OF INTELLIGENCE**

##### ***Workshop 2.1.1: New Mathematics for Semantic Foundations--C. Hewitt (MIT), Chair (Morning Session)***

- C. Hewitt (MIT), Synthetic Space-Time
  - J. Goguen, G. Malcolm (U. of California at San Diego), A Hidden Agenda
  - M. Clavel, J. Meseguer (SRI), Metalogica Foundations for Reflection
  - other presenter to be announced
- ##### ***Workshop 2.1.2: Syntactics of Intelligent Systems: The Kinds of Logic Available--M. Kokar (Northeastern U.), Chair (Afternoon Session)***
- W. Farmer (MITRE), Perspective Switching Using Theories and Interpretations
  - W. Zadrozny (IBM T.J. Watson Research Center), A Computational Triadic Logic of Signs
  - M. Kokar (Northeastern U.), Developing Open Systems Using Theories and Models of the World
  - M. Vardi (Rice U.), Common Knowledge: Now You Have It, Now You Don't
  - J. Tomasik (U. de Clermont-Ferrand, France), Rasiowa's Completion versus Keisler's Saturation: Towards Pragmatics of an Infinite Fusion
  - R. Nossur (Agder College, Norway), Semiotic Labeled Deductive Systems
  - S. Petrov (Oak Ridge National Lab.), Inference in Poor Languages

#### **TRACK 2: IN SEARCH OF RESEMBLANCE**

##### ***Workshop 2.2.1: Intelligence of Recognition: the Semiotic Tools I--L. Perlovsky (NRC), Chair (Morning Session)***

- L. Perlovsky (Nichols Research Corp.), Intelligence and Recognition
- D. Casasent (Carnegie Mellon U.), Detection, Information Fusion, and Temporal Processing for Intelligence in Recognition
- G. Ritter (U. of Florida), Morphological Neural Networks
- R. Golden (U. of Texas, Dallas), Classical Methods for Interpreting Objective Function Minimization as Intelligent Inference
- E. Manolakos (Northeastern U.), Soft Decision Algorithms for Object Recognition

## ***Preliminary Agenda***

### **DAY 2, October 22: Recognition of Systems**

#### **TRACK 2: IN SEARCH OF RESEMBLANCE**

##### ***Workshop 2.2.1 (cont.)***

- J. Principe (U. of Florida), Recognition Algorithms for Time Varying Patterns

##### ***Workshop 2.2.2: Intelligence of Recognition: the Semiotic Tools II--L. Perlovsky (NRC), Chair (Afternoon Session)***

- A. Reeves (Northeastern U.), Recognition of Mis-oriented Pictures
- D. Levine (U. of Texas), Neural Network Architecture for Prefrontal Executive Function
- H. Szu (U. of SW Louisiana), Wavelets as Intelligent Preprocessing of ANN
- R. Coifman (Yale U.), Adaptive Wavelet Packet Feature Extraction
- W. Punch (U. of Michigan), Use of Genetic Algorithms and Genetic Programming in Recognizing Important Features in Large Databases

#### **TRACK 3: TOOLS FOR GENERALIZING**

##### ***Workshop 2.3.1: Semiotics of Neural Networks --P. Werbos (National Science Foundation), Chair (Morning Session)***

- G. Agre, I. Koprinska (Bulgarian Academy of Sciences), Case-Based Refinement of Knowledge-Based Neural Networks
- J. R. Alexander (Towson State U.), Biological Suggestions for Alternative Designs of Artificial Neural Networks
- A. Averkin (Russian Academy of Sciences), Fuzzy Logic Simulation Technology in Semiotic Systems
- L. Dolmatova (U. de Lille, France), Multi-Level Information Processing Using the Combination of Neural Networks
- V. Protopopescu, N. S. V. Rao (Oak Ridge National Lab), Outsmarting Neural Networks
- N. Farhat, E. Del Mozal Hernandez (U. of Pennsylvania), Transient Chaotic Search in Dynamic Networks
- A. Ling (NIST), Thermal Error Modeling of Machine Tools Using Recurrent Neural Networks

##### ***Workshop 2.3.2: Applications of Computing with Words --P. Wang (Duke U.), Chair (Afternoon Session)***

- P. Wang (Duke U.), Hierarchical Control System Design Using the Concepts of Semiotics & Computing With Words

## ***Preliminary Agenda***

### **DAY 2, October 22: Recognition of Systems**

#### **TRACK 3: TOOLS FOR GENERALIZING**

##### ***Workshop 2.3.2 (cont.)***

- B. Rieger (U. of Trier, Germany), Computational Semiotics and Fuzzy Linguistics
- T. Whalen (Georgia State U.), G. Gim, (Soong Sil U.), Perspicuity and Robustness in a Hybrid Approach to Knowledge Acquisition
- M. Ben Ghalia (Duke U.), P. Wang (Duke U.), Optimal Control of a Big Hotel Complex
- G. Gim (Soong Sil U.), T. Whalen (Georgia State U.), Logical Second Order Models: Achieving Synergy Between Computer Power and Human Reason.
- B. Schott, T. Whalen (Georgia State U.), Term Set Design in Fuzzy Controllers
- E. H. Ruspini (SRI), Generation of Qualitative Object Descriptions

#### **TRACK 4: UNDERSTANDING THE AGENTS**

##### ***Workshop 2.4.1: Semiotics in the World of Intelligent Agents--S. Barber (U. of Texas at Austin) and S. Ramaswami (Georgia Southwestern College), Chairs (Morning Session)***

- S. Barber (U. of Texas at Austin), Overview of Sensible Agents
  - S. Ramaswami (Georgia Southwestern College), Behavioral Modeling of Sensible Agents
  - T. Graser (U. of Texas at Austin), Meta-Modeling of Sensible Agents
  - C. Martin (U. of Texas at Austin), Representation of Autonomy in Distributed Agent-based Systems
  - R. Macfadzean (Naval Surface Warfare Center), Reasoning About Autonomy Level Assignment
  - A. Goel (U. of Texas at Austin), Conflict Resolution for Sensible Agents
  - J. Joninas (Eastman Kodak), Manufacturing Case Study
  - R. Macfadzean (Naval Surface Warfare Center), Naval Combat System Case Study
- ##### ***Workshop 2.4.2: Memory Complexity and Control in Biological and Artificial Systems --Y. Yufik (Institute of Medical Cybernetics, Inc.), Chair (Afternoon Session)***
- K. Corker (NASA Ames Res. Center), MIDAS: Modeling and Simulation of Complex Piloting Tasks



## ***Preliminary Agenda***

### **DAY 2, October 22: Recognition of Systems**

#### **TRACK 4: UNDERSTANDING THE AGENTS**

##### ***Workshop 2.4.2 (cont.)***

- K. Vicente (U. of Toronto), Ecological Approach in the Design of Complex Systems
  - M. Voloshin (Inst. of Medical Cybernetics, Inc.), Central Mechanisms of Motor Control and the Role of Memory in the Organization of Complex Movements
  - Y. Yufik (Inst. of Medical Cybernetics, Inc.), T. Sheridan (MIT), Human Memory and Cognitive Complexity, Computer Memory and Computational Complexity: Where is the Difference
  - P. Kugler (U. of Radford), Measurement of Instability in Biological Control Systems: a Problem of Emergence
- Banquet: Gaithersburg Marriott Washingtonian  
Speaker: Alex Meystel, "Multiresolutional Mind"

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### **DAY 3, October 23: Interpretation of Processes**

**Plenary Lecture:** Panos J. Antsaklis (U. of Notre Dame), Hybrid Control of Intelligent Systems

#### **TRACK 1: INTELLIGENT SYSTEMS IN USE**

##### ***Workshop 3.1.1: Intelligent Manufacturing Systems I--J. Albus (NIST), Chair (Morning Session)***

- J. Albus (NIST), Intelligent Systems Architecture for Manufacturing
- A. Meystel (NIST, Drexel U.), Multiresolutional Techniques for Reducing Complexity of Engineering Solutions
- E. Barkmeyer, N. Christopher (NIST), System Integration for Manufacturing Applications
- N. Christopher (NIST), Software Integration Framework for Discrete Parts Manufacturing
- M. Herzman, T. Hong (NIST), Image Processing for Manufacturing and Mobility
- A. Wavering, E. Keut (NIST), A Hexapod Testbed for Virtual and Distributed Manufacturing
- T. Hopp, C. Diaz, D. Flater (NIST), Algorithm Testing and Evaluation Program: Manufacturing Information Technology Testing Services
- A. Donmez (NIST), Performance Models for Machine Tools

## ***Preliminary Agenda***

### **DAY 3, October 23: Interpretation of Processes**

#### **TRACK 1: INTELLIGENT SYSTEMS IN USE**

##### ***Workshop 3.1.1 (cont.)***

- R. Sriram, K. Lyons (NIST), Process Modeling
  - H. Huang, E. Messina (NIST), NIST-RCS and Object-Oriented Methodologies of Software Engineering
- ##### ***Workshop 3.1.2: Intelligent Manufacturing Systems II --J. Albus (NIST), Chair (Afternoon Session)***
- A. Jones (NIST), Algorithms of Scheduling
  - H. Scott (NIST), An Integrated Control Architecture for Inspection
  - F. Proctor (NIST), Interfaces for Multiagent Intelligent Systems: Lessons of EMC
  - S. Lee, P. S. Schenker (Jet Propulsion Lab., U. of Southern California), Autonomous Synthesis of Goal-Oriented Behaviors for Intelligent Robotic Systems
  - J. Albus, R. Bostelman, A. Jacoff (NIST), RCS-Based RoboCrane Integration
  - S. Ray (NIST), Representation Requirements for Planning
  - J. Albus, A. Lacaze, (NIST), A. Meystel (NIST, Drexel U.), Planning in the Hierarchy of NIST/RCS for Manufacturing
  - C. McLean (NIST), Tools for Design of Engineering of Production Systems
  - M. Mitchell (NIST), Product Data for Manufacturing
  - P. A. Ramamoorthy, (U. of Cincinnati), Stability Issues in Semiotic Modeling & Situational Control
  - F. M. Brown (U. of Kansas), Reducing the Cost of Designing, Implementing, and Modifying Intelligent Systems by Use of Multivalued and Symbolic Abstractions

#### **TRACK 2: APPLIED SEMIOTICS**

##### ***Workshop 3.2.1: Theoretical Issues of Applied Semiotics --A. Meystel (NIST, Drexel U.), Chair (Morning Session)***

- B. Rieger (U. of Trier, Germany), Computational Semiotics and Fuzzy Linguistics
- G. Goguen (U. of California at San Diego), Semiotic Systems on Semiotic Morphisms
- J. van der Lubbe (Delf U. of Technology, Netherlands), A Peircean Approach to AI

## ***Preliminary Agenda***

### **DAY 3, October 23: Interpretation of Processes**

#### **TRACK 2: APPLIED SEMIOTICS**

##### ***Workshop 3.2.1 (cont.)***

- G. Cybenko (Dartmouth U.), The Shannon Machine: Integrating Communications and Computing
- F. Zhao, et al. (Ohio State U.), Spatial Aggregation Language and Applications
- M. Sulkoski (National Geographic Information Service), L. Miller (Department of Defense), Non-Linguistic Semiotic Control Q-Analysis
- R. Harbort (George Mason U.), Identity, Intentionality, and Interpretation
- L. Kauffman (U. of Illinois at Chicago), Sign and Space
- D. Duong (George Mason U.), An Iterated Prisoner's Dilemma Based on Symbolic Interactionism

##### ***Workshop 3.2.2: Multiresolutional Methods--A. Meystel (NIST, Drexel U.) and I. Muchnik (Rutgers U.), Chairs (Afternoon Session)***

- A. Meystel (NIST, Drexel U.), Multiresolutional Representation and Behavior Generation
- B. Mirkin (DIMACS), A Discrete Analogue of the Wavelet-Based Multiresolutional Approximation
- K. Izzetoglu, M. Izzetoglu, A. Erkmén (Turkey), Textured Data and Feature Fusion Based on Fuzzy Fractal Dimension Towards Textured Perception
- I. Muchnik, S. Streltsov, P. Vakili, E. Khmelnitsky (Rutgers U., Boston U., Tel Aviv U.), Multiresolutional Approach to Search Problems: Perspectives and Limitations
- A. Mehler (U. of Trier, Germany), Multiresolutional Approach to Fuzzy Text Meaning
- B. Stilman (U. of Colorado), A. Yakhnis (Sandia National Laboratories) Managing Large State Spaces for High Consequence Systems via Linguistic Geometry Trajectories
- W. J. Davis (U. of Illinois at Urbana-Champaign), Real-Time Emulation and Simulation of Multiresolutional Control Architectures for Complex Discrete-Event Systems

##### ***Workshop 3.2.3: Semiotic Methodologies for Defense Application--T. Reader (U.S. Army), Chair (Classified Morning Session)***

## ***Preliminary Agenda***

### **DAY 3, October 23: Interpretation of Processes**

#### **TRACK 3: SPECIFICS OF THE LARGE AND COMPLEX**

##### ***Workshop 3.3.1: Economics and Semiotics: The Costs and Productivity of Meaning--S. Leven (Scientific Cybernetics), Chair (Morning Session)***

- S. Leven (Scientific Cybernetics), Communication, Interaction, and Decision: the Semiotic Context of Economic Action
- R. Axtell (Brookings Institution), Simulating Real Economies: Problems and Prospects
- A. De Vany (Center for Computable Economics), Economic Actors as Evolution's Tools: Modeling Biology
- R. Smith (Arthur Andersen), Firms as Complex Systems: From Meaning to Autopoiesis - and Back
- F. Pryor (Swarthmore College), Complexity, Social Structure, and Belief in the American Economy
- R. Langlois (U. of Connecticut), Meaning and Context in Organizations: Why and How They Work

##### ***Workshop 3.3.2: Operator's Modeling as A Semiotic Paradigm--D. Filev (Ford Motor Co.) and G. Vatchevanos (Georgia Tech), Chairs (Afternoon Session)***

- Y. Chen (U. of Michigan, Dearborn), An Information Gain Based Index Evaluation and Learning Scheme for Acquiring Diagnostic Knowledge of Machining Systems
- G. Vatchevanos, W. Mahmood, S. Kim (Georgia Tech.), A Neuro-Fuzzy Implementation of an Operator's Model
- D. Filev (Ford Motor Co.), Fuzzy Estimation of Unmeasurable Process Variables by Using Operator's Model
- I. Muchnik, A. Genkin, C. A. Kulikowski (Rutgers U., Institute of Communications, Russia), Causal Coverage for Diagnostic Hypothesis Generation as Submodular Set Function Maximization
- D. K. Pathak (DEC), Intelligent Decision Making Based On Graphs
- W. Stirling, M. Goodrich, R. Frost (Brigham Young U.), Satisficing Intelligent Decisions Using Epistemic Utility Theory
- A. Deshmene (Ford Motor Co.), Using Fuzzy Logic in Subjective to Objective Correlation in Power-Train Evaluation
- C. Mitchell (Georgia Tech), Task Analytic Models of Human Operators: Designing Operator-Machine Interactions

### ***Tour and Special Meeting***

Participants will have the opportunity to tour several projects under way in the NIST Intelligent Systems Division. The overarching theme of these projects is Intelligence for Next Generation Systems.

In addition, there will be a meeting of International Association of Intelligent Systems. The meeting will be conducted by J. Albus, M. Jamshidi, A. Meystel, and L. Zadeh.

### ***Poster Session***

Participants who wish to participate in the conference poster session should submit a one-page abstract by **September 15, 1996**. Authors of accepted abstracts will be notified by a request for a full paper. They will also receive a copy of the rules for submission. Abstracts should be sent to:

**James Albus, General Chair**

NIST

Bldg. 220, Rm. B124

Gaithersburg, MD 20899-0001

Telephone: (301) 975-3418

Fax: (301) 990-9688

email: [albus@cme.nist.gov](mailto:albus@cme.nist.gov)

**Alex Meystel, Program Chair**

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Fax: (301) 990-9688

email: [meystel@cme.nist.gov](mailto:meystel@cme.nist.gov)

### ***Tutorials***

Seven tutorials will be offered at NIST on Sunday, October 20, the day preceding the opening of the conference. There is a separate registration fee of **\$120** per person to attend the tutorials. Please refer to the "Registration" section of this brochure for further information.

#### **Sunday, October 20**

1. Applied Semiotics: Theory, Methodology, Toolbox (by A. Meystel) (FULL DAY)
2. A Linguistic Geometry for Multiscale Intelligent Planning and Control: Optimal Strategies in War Scenarios, Manufacturing, Positional Games (by B. Stilman) (FULL DAY)
3. Fuzzy Relations and Algorithms -- A Tool for Empirical Study of Meaning (by L. J. Kohout) (HALF-DAY)
4. Fuzzy Constraint Network for Intelligent and Complex Systems (by P. Wang) (HALF-DAY)
5. The Semiotic Approach to Abduction in Artificial Intelligence (by J. C. A. van der Lubbe) (HALF-DAY)
6. Transformations of Intelligent: Linguistics to Computations (by I. B. Turksen) (HALF-DAY)
7. A Novel Structure of 'Brain-like' Neural Networks (by A. Roy) (HALF-DAY)

These tutorials provide an overview of semiotics as a science, demonstrate its relationship to other scientific domains, and outline its links with cybernetics and artificial intelligence. The focus is on applied semiotics and its significance to different stages of development of large and complex systems. For further information on the content of the tutorials, contact Alex Meystel, Program Chair (see "Technical Contacts").

### *Location*

The National Institute of Standards and Technology, Administration Building (101), Green Auditorium, Gaithersburg, Md. Gaithersburg is located approximately 20 miles northwest of Washington, D.C.

### *Registration*

The Conference (October 21-23) registration fee is **\$385** per person and includes conference materials, proceedings, coffee breaks, lunches, a reception, and banquet. The Tutorial (October 20) registration fee is **\$120** per person and includes tutorial materials and coffee breaks. The fee is **\$505** to register for **both** the conference and the tutorial. Enclosed are two separate registration cards, one for the conference and one for the tutorial. To register, please complete the appropriate registration card(s) and send it with payment to NIST, Office of the Comptroller or fax it to Lori Phillips (see registration cards). For your name to appear on the preliminary participants' list, registrations for both the conference and the tutorial must be received no later than **Monday, October 7, 1996**. Requests for refund or cancellation (for both events) must also be received, in writing, by **October 7**.

### *Accommodations*

A block of rooms has been reserved at the Gaithersburg Marriott Washingtonian Center, **(301) 590-0044**, at a special rate of **\$90**, single or double, and at the Gaithersburg Hilton, **(301) 948-8900**, at a special rate of **\$80**, single or double. Please add 12% tax to this rate. To register for a room, please complete the enclosed hotel reservation card and send it directly to the hotel of your choice no later than **Monday, September 30, 1996**. After that date, the rooms will be released for general sale at the prevailing rates of the hotel.

### *Coffee Breaks and Lunch*

Refreshments will be provided during breaks. Lunch will be provided for conference attendees each day. Lunch will not be provided for the tutorial on Sunday, October 20.

### *Social Events*

To provide an opportunity for informal interaction, a cash-bar reception with hors d'oeuvres will be held on Monday, October 21, at the Gaithersburg Hilton. A banquet will be held on Tuesday, October 22, at the Gaithersburg Marriott. The banquet speaker will be Alex Meystel, NIST, Drexel University.

### *Transportation*

BWI Super Shuttle, **(301) 369-0009**, offers commercial van service from Baltimore-Washington International Airport to the Gaithersburg area. Call for reservations. Crystal Airport Shuttle, **1-800-872-2797**, is available from Dulles International and Washington National Airports to Gaithersburg. The cost is \$19 - \$30 one-way.

The Washington Metro has subway service to Gaithersburg. The Metro System can be boarded at Washington National Airport. Take the Yellow Line train marked "Mount Vernon Square" to Gallery Place and transfer to the Red Line train marked "Shady Grove" to the Shady Grove station in Gaithersburg. Service is every 6 to 15 minutes depending on the time of day. Travel time from National Airport to Shady Grove is approximately 50 minutes. Taxis are available from the Shady Grove Metro station to area hotels.

A NIST shuttle van operates for official visitors from the Shady Grove metro station to NIST on weekdays. The van leaves the Shady Grove station on the quarter and three-quarter hour (e.g. 8:15, 8:45, . . . 4:45, 5:15) from the east side parking lot. Roundtrip bus transportation will be provided between the conference hotels and NIST each day.

### ***Registration Contact***

#### **Lori Phillips**

NIST

Bldg. 101, Rm. B116

Gaithersburg, Md. 20899-0001

Telephone: (301) 975-4513

Fax: (301) 948-2067

e-mail: lori.phillips@nist.gov

### ***Technical Contacts***

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Telephone: (301) 975-4455

Fax: (301) 990-9688

email: meystel@cme.nist.gov

### ***Registration Card Semiotic Tutorials October 20, 1996***

Last Name \_\_\_\_\_

First Name \_\_\_\_\_

Organization \_\_\_\_\_

Street Address \_\_\_\_\_

Rm. No./Mail Code \_\_\_\_\_

City, State, Zip \_\_\_\_\_

Business Telephone \_\_\_\_\_

Fax No/email \_\_\_\_\_

Special Assistance \_\_\_\_\_

***Tutorial Registration Fee: \$120 (register separately for the conference)***

#### **Form of Payment:**

Check enclosed made payable to: NIST/Semiotic Tutorials.

(Checks from outside USA should be written on a US bank.)

Master Card \_\_\_\_\_ Exp. \_\_\_\_\_

Visa Card \_\_\_\_\_ Exp. \_\_\_\_\_

Authorized Signature \_\_\_\_\_

Purchase order/Training form enclosed

(Faxed copy unacceptable; provide one on-site at registration.)

**Please indicate the tutorial session(s) which you are interested in attending:**

- 1) Applied Semiotics (Full Day).
- 2) Linguistic Geometry for Multiscale Intelligent Plan (Full Day)
- 3) Fuzzy Relations and Algorithms (Half-day)
- 4) Fuzzy Constraint Network (Half-day)
- 5) Abduction in Artificial Intelligence (Half-day)
- 6) Linguistics to Computations (Half-day)
- 7) "Brain-like" Neural Networks (Half-day)

**REQUESTS FOR CANCELLATION & REFUND MUST BE  
RECEIVED IN WRITING, BY OCTOBER 7, 1996.**

*Please return this form by October 7, 1996 to:*  
*Office of the Comptroller*  
*A807 Administration Bldg.*  
*National Institute of Standards and Technology*  
*Gaithersburg, Md. 20899-0001 USA*

*or*

*Fax to:*  
*Lori Phillips*  
*(301) 948-2067*

***Driving Instructions***

**To reach NIST:**

Traveling north on I-270: take Exit 10, Rt. 117 West, Clopper Road. At the first light on Clopper Road, turn left onto the NIST grounds.

Traveling south on I-270: take Exit 11B, Rt. 124 West, Quince Orchard Road. At the second light turn left onto Clopper Road. At the next light, turn right onto the NIST grounds.

To reach the Administration Building, turn left after passing the guard office. Signs will direct you to visitor parking.

**To reach the Gaithersburg Marriott Washingtonian Center:**

On northbound I-270: take I-495 to I-270 north to exit 9B, Sam Eig Highway West. Take the first left onto Fields Road, then take the first left onto Rio Boulevard, which becomes Washingtonian Boulevard. Turn left into the Marriott after you pass the Rio complex.

**To reach the Hilton:**

From Washington, D.C., on northbound I-270: take Exit 11, Route 124 East, Montgomery Village Avenue. At the second traffic light, veer right onto Route 355 (Frederick Avenue). Follow Route 355 and turn right at the first light onto Perry Parkway. The hotel will be on the right.

On southbound I-270: take Exit 11A, Montgomery Village Avenue and follow the above directions.